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I, LEANNE MYNOTT, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. PQ 0886 for a patent by TENTAS TELEHEALTH PTY LTD filed on 10 June 1999.

WITNESS my hand this
Twenty-seventh day of June 2000

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POWER SAVING LEADS STATUS MONITORING

The present invention relates to the field of battery operated devices such as devices used for monitoring a cardiac patient's electrical cardiac activity and, in particular, to the operation of a power saving or sleep mode of an ECG acquisition system.

BACKGROUND TO THE INVENTION

In battery operated devices, power consumption is a very important technical characteristic. In order to reduce power consumed by the device, microcontrollers of devices, such as as ECG monitors, use a sleep mode whereby a minimal amount of energy is consumed from the battery.

Often automatic initiation of such a sleep mode and activation of the microcontroller for power and energy saving purposes is based on special requirements and criteria associated with the functionality of the device.

In the case of the ECG acquisition device, one of the important requirements is signal quality monitoring. If leads of the device are disconnected from a patient, no ECG can be acquired and the device can save power by using a sleep mode.

Similarly, the patient's compliance also dictates continuous monitoring of the leads status in sleep mode in order to automatically activate the device upon disconnection or connection of the leads.

Such a task requires at least some of the elements, such as front-end amplifiers, to be operational in sleep mode which means that there is an undesirable power drain from the batteries of known devices.

It would be advantageous to provide a method and apparatus which provides a power supply arrangement which prevents an undesirable power drain.

OBJECT OF THE INVENTION

It is an object of the present invention to provide a method and apparatus for power saving which substantially overcomes or ameliorates the above mentioned disadvantages.

DISCLOSURE OF THE INVENTION

According to one aspect of the present invention there is disclosed a method of operating an acquisition and monitoring device which uses contact means to detect and acquire signals, said device having a sleep mode, a wake mode and an operational mode, said method including the steps of providing an auxiliary oscillator in said device to provide a periodic interrupt signal to wake the device from the sleep mode to the wake mode where power is supplied to the device is minimal, testing connection of contact means to said device after receipt of said periodic interrupt signal, initiating the sleep mode if no connection of contact means is detected or initiating the operational mode if connection of contact means is detected.

Preferably, the auxiliary oscillator is a low power, low frequency oscillator.

Preferably, the interrupt signal turns on front end amplifiers of said device and has a period of about 2 seconds.

Preferably, the test execution time is about 0.005 seconds.

BEST MODE OF CARRYING OUT THE INVENTION

The method according to the power saving system of the preferred embodiment uses a "sleep-wakeup-check-sleep" sequence for automatic activation of an ECG acquisition and monitoring device. When such a device is used to monitor a patient, it is important for the device to know when the ECG leads are in contact with the patient's skin. If the leads are not in contact, the device is in a sleep mode.

The method includes the use of providing an auxiliary, low power, low frequency oscillator to generate an interrupt signal to "wake up" the microcontroller of the device. The timeout of the interrupt signal is preferably set to occur every few seconds.

On the interrupt condition, ie when the interrupt signal is generated, the microcontroller switches on power for front end amplifiers of the device, waits for a short settling time, tests leads status, (ie whether there is contact or not), and then initiates sleep mode if the leads are not in contact. These routines are preferably performed in a very short time period in comparison to the interrupt timeout period.

Thus the power saving system of the preferred embodiment monitors the status of the leads within periods defined by the interrupt timeout signals. With the interrupt timeout period being much longer than the time period of the leads status test, a sufficient ratio of sleep time to active time is achieved.

In the case where the timeout period is 2 seconds and the test exection time is 0.05 seconds, the ratio is 1:40.

The foregoing describes only one embodiment of the present invention, and modifications obvious to those skilled in the art can be made thereto without departing from the scope of the present invention.

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